
Name of Organization: USGS

Type of Organization: Federally-funded R & D Center

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Project Title: Ecological assessment of fishes of the Grand Calumet River

Project Category: Contaminated Sediments

Rank by Organization (if applicable): 0

Total Funding Requested (\$): 223,000 **Project Duration:** 2 Years

Abstract:

Ecological Assessment of Fishes of the Grand Calumet River: DELT Anomalies and Embryo Larval Toxicity Testing

Historically, the Grand Calumet River had sections wherein no fish were found. While fish assemblages in the river are still considered impaired by the IJC, most areas possess resident fish assemblages. In some areas, fish assemblages were observed to have a large percentage of deformities, eroded fins, lesions, and tumors (DELTS, personal observation). The purpose of this research will be to assess the health of fish assemblages in the Grand Calumet River by examining population structure and function, quantifying the percentage of DELT anomalies, performing embryo larval toxicity testing, and quantifying contaminants in sediments and fish tissues. Fish will be sampled by electroshocking areas where a high percentage of DELTs have been observed. This work relates to EPA interests since this is a Great Lakes Area of Concern, part of the Coastal Wetlands of the Great Lakes, and are prime gathering areas for fish that spend part of their life in Lake Michigan and part in the river.

Geographic Areas Affected by the Project

States:

- | | |
|---|---------------------------------------|
| <input type="checkbox"/> Illinois | <input type="checkbox"/> New York |
| <input checked="" type="checkbox"/> Indiana | <input type="checkbox"/> Pennsylvania |
| <input type="checkbox"/> Michigan | <input type="checkbox"/> Wisconsin |
| <input type="checkbox"/> Minnesota | <input type="checkbox"/> Ohio |

Lakes:

- | | |
|--|------------------------------------|
| <input type="checkbox"/> Superior | <input type="checkbox"/> Erie |
| <input type="checkbox"/> Huron | <input type="checkbox"/> Ontario |
| <input checked="" type="checkbox"/> Michigan | <input type="checkbox"/> All Lakes |

Geographic Initiatives:

- | | | | | |
|---|----------------------------------|--|--------------------------------------|---|
| <input checked="" type="checkbox"/> Greater Chicago | <input type="checkbox"/> NE Ohio | <input checked="" type="checkbox"/> NW Indiana | <input type="checkbox"/> SE Michigan | <input type="checkbox"/> Lake St. Clair |
|---|----------------------------------|--|--------------------------------------|---|

Primary Affected Area of Concern: Grand Calumet River/IHC, IN

Other Affected Areas of Concern:

For Habitat Projects Only:

Primary Affected Biodiversity Investment Area: Chicago Wilderness

Other Affected Biodiversity Investment Areas:

Problem Statement:

The rivers of the southern Lake Michigan region have experienced some of the most destructive alterations known in riverine systems. The Lake Michigan watershed has shown a 22% decline in the number of native fish species and the Grand Calumet River has the highest proportion of exotic species of any inland waters in northwest Indiana. The Grand Calumet River/Indiana Harbor and Nearshore Lake Michigan AOC is one of the largest contributors of contaminants to the Great Lakes. The fish community of the Grand Calumet River comprises only 21 species, is dominated by cyprinids (90%), and produces very poor scores on the Index of Biotic Integrity. Much of the of the Grand Calumet River historically lacked a resident fish population. While improvements have been made in water quality, biological impairment of fish assemblages continue.

Community indicators of degraded fish communities include high proportion of exotic and tolerant species and the complete absence of intolerant species. The proportion of individuals with deformities, eroded fins, lesions, and tumors (DELTs) depicts the health and condition of individual fish. These occur infrequently at minimally impacted reference sites, but occur frequently below point sources and areas where toxic chemicals are in high concentrations. Reash and Berra (1989) evaluated the effects of urban outfalls on a stream and found that many species of short- and long-lived fishes were affected. In addition, Baumann et al. (1987) found that benthic species such as bullheads and white sucker were particularly vulnerable to gross abnormalities as a result of feeding and contact with the sediments. DELT anomalies are caused by contaminants present in the water or sediments and are externally visible morphological deformities and morphometric changes in aquatic animals. Deformities designate morphological malformations, due to physiological effects of one or more toxicants, and exclude damage caused by mechanical stress or wear, ageing, and anomalies within the phenotypical plasticity of the species.

Preliminary sampling of the Grand Calumet River fish community has found a high proportion (>40%) of fish with DELTs at several sites (personal observation). These deformities include eroded fins and severe eye abnormalities in several species. .

Objectives/Hypotheses: The objectives of this study are to investigate biological impairment of fish communities with emphasis on DELT anomalies and community structure and function. We will perform embryo-larval toxicity and teratogenicity tests to determine if water from the area can induce the presence of certain DELT anomalies. If we establish that DELTs are related to water quality, we will determine the concentrations of contaminants in the water and the sediments that would induce these malformations. In addition, fish tissue concentrations of contaminants will be measured to determine if there is relationship between water and sediment contaminant concentrations and contaminant concentrations in fish tissues.

Objectives:

Part 1. Identify and classify DELT anomalies among individuals of all fish species.

Part 2. Perform chronic embryo-larval toxicity tests using fathead minnows.

Hypotheses:

H1: While the biological integrity of the Grand Calumet River has generally improved, there remain areas of extremely poor fish community structure and function. These areas coincide with the greatest occurrence of DELT anomalies, the greatest larval death and deformities as shown in the embryo-larval toxicity tests (Simon 1989), and the highest contaminant concentrations in the water and sediments of the river. Areas with poorest community structure and function should be the areas with the greatest number of DELTs and highest concentrations of contaminants.

H2: Fish trophic or guild levels (i.e., herbivore, carnivore) show different responses to contaminants due to differences in tolerance and life histories of the higher-level species. These different responses should manifest themselves as differential changes in DELT expression. We expect that long-lived species should show the greatest number of DELT anomalies.

Proposed Work Outcome:

This work will be of interest to EPA since this area is a Great Lakes Area of Concern, part of the Coastal Wetlands of the Great Lakes, and is a spawning area for fish that spend part of their life in Lake Michigan and part in the river. These fish are consumed by the public, and even though present, are still impaired. The degree of impairment will be assessed.

A report (peer-reviewed publication) will be prepared describing the health of the fish community at selected areas of the Grand Calumet River and relating these to sediment and tissue concentrations of contaminants. This report will also present information on teratogenic effects of Grand Calumet River water on fathead minnows.

Project Milestones:	Dates:
Project Start	08/2000
First field season	09/2000
Toxicity testing	10/2000
Sediment and tissue analysis	10/2000
Second field season	07/2001
Draft report	11/2001
Final report	11/2001
Project End	12/2001

Project Addresses Environmental Justice

If So, Description of How:

Project Addresses Education/Outreach

If So, Description of How:

Project Budget:

	Federal Share Requested (\$)	Applicant's Share (\$)
Personnel:	110,000	60,000
Fringe:	15,000	8,000
Travel:	5,000	2,000
Equipment:	10,000	10,000
Supplies:	2,000	1,000
Contracts:	45,000	0
Construction:	0	0
Other:	0	0
Total Direct Costs:	187,000	81,000
Indirect Costs:	36,000	21,000
Total:	223,000	102,000
Projected Income:	0	0

Funding by Other Organizations (Names, Amounts, Description of Commitments):

Matching: U.S. Geological Survey
In-kind service
Salary of P.I.
Boats, motors, other gear
Time from co-operators and partners.

Description of Collaboration/Community Based Support:

U.S. Fish and Wildlife Service, Bloomington Field Office, Trustee
Indiana Department of Environmental Management, Trustee
Indiana Department of Natural Resources, Trustee